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(54) Board structure

(57) This invention consists of laminated rigid or semi rigid board made from paper, plastics or the like which provides layers of sheet material laminated with sheets of contoured material to provide a plane exterior surface and a substantially cellular interior. The upper surface of said contoured material is formed into configurations of alternate upstanding and indented shapes in the form of flutes, truncated pyramids or the like, which shapes are reproduced in reverse on the lower surface. The strength of the said board is intended to be non-directional except by specific design requirement. Additional strengthening material such as metal in suitable form may be incorporated.

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Title : "Board structure innovation"

Fig. 1.  
Two configurations of  
fluted moulded inner  
sections of board.

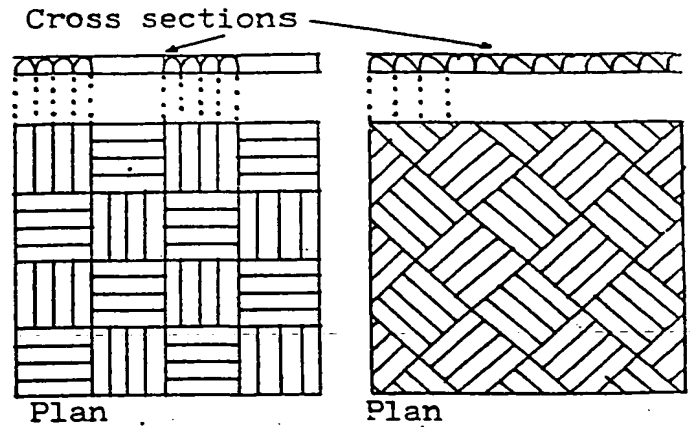


Fig. 2.  
Cross corru-  
gated board.

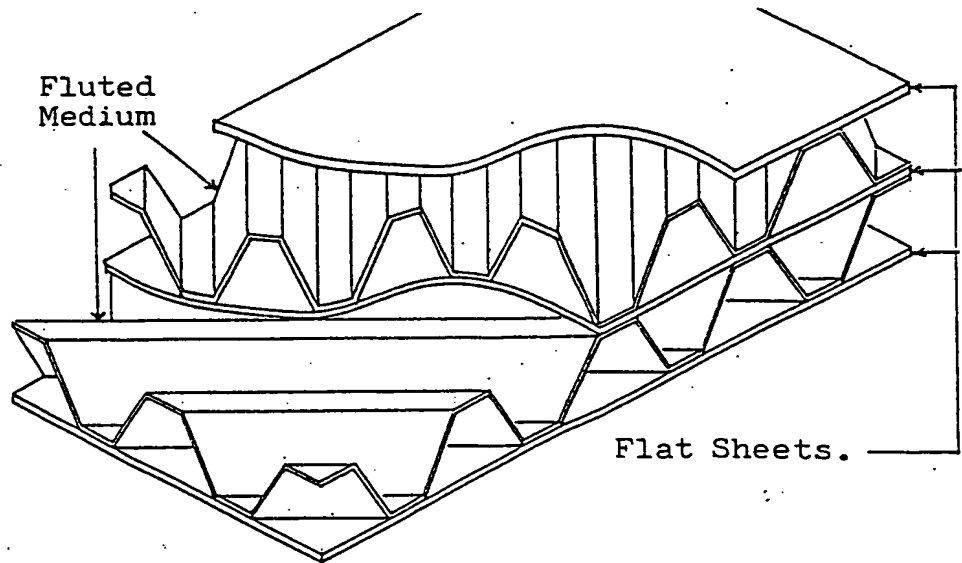
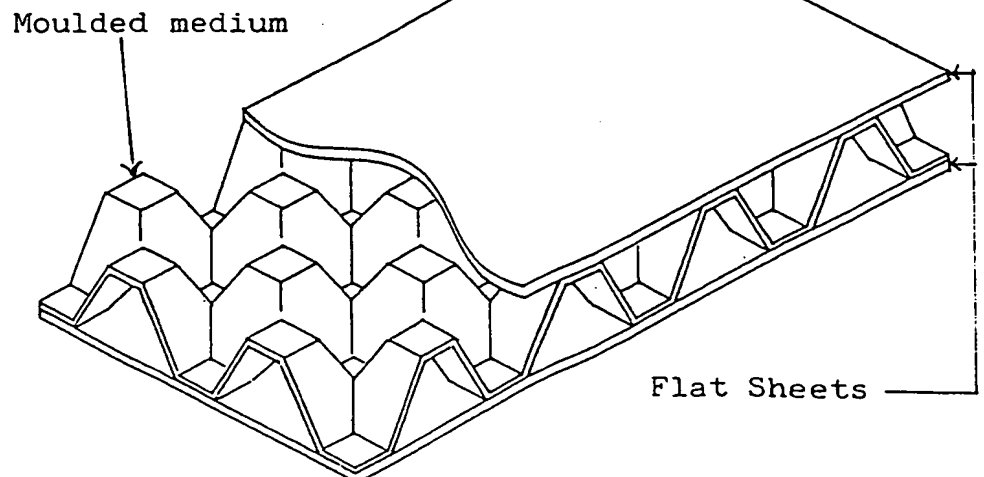


Fig. 3.  
Cellular Board.  
- one example  
of possible  
configuration  
of moulded  
interior.



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Examples of possible cellular arrangements:

Fig. 4.

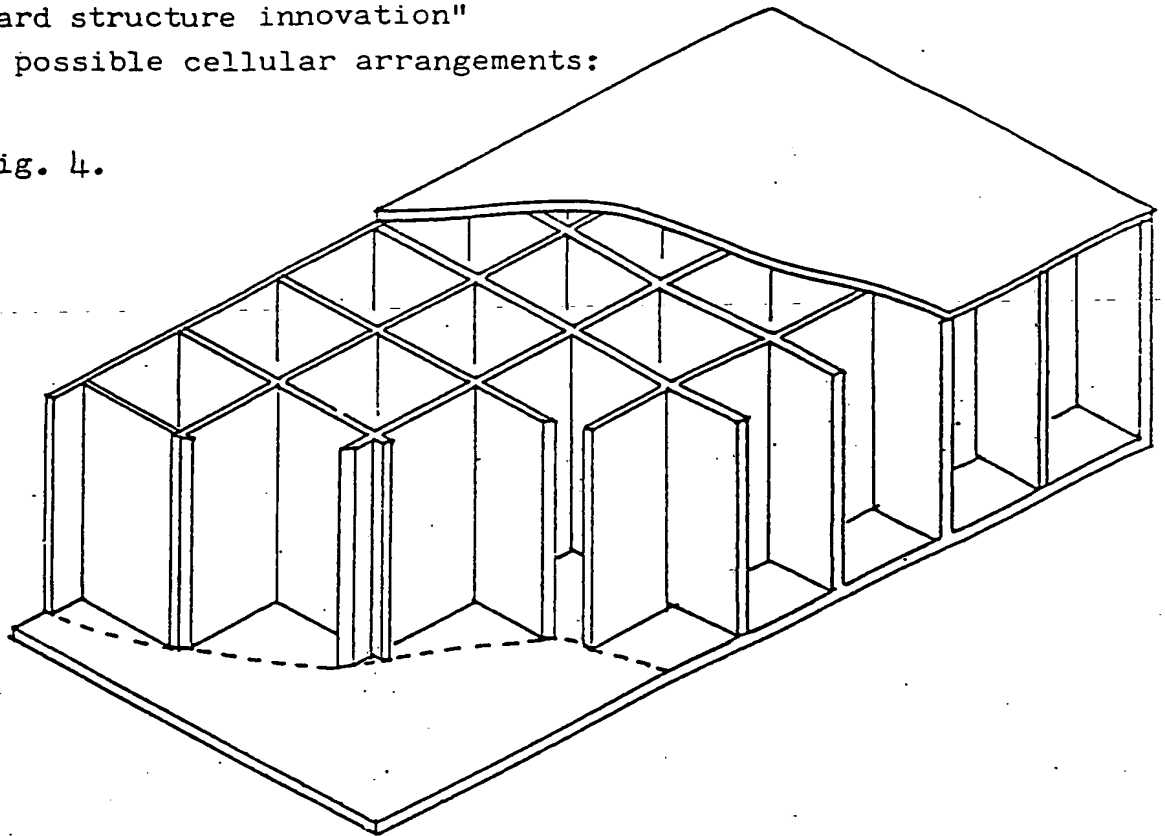
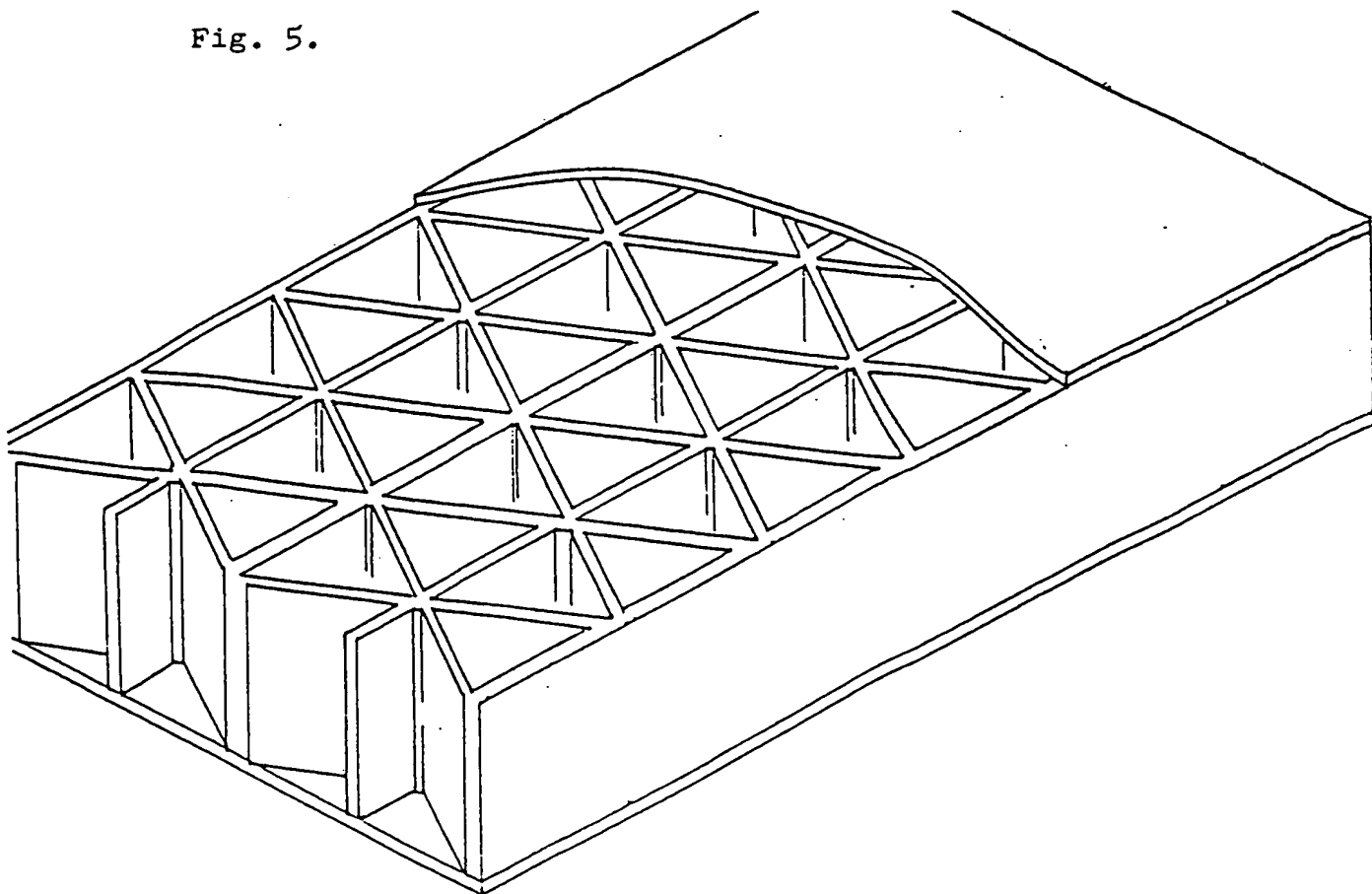


Fig. 5.



## SPECIFICATION

## Board structure innovation

- 5 There are established packaging and structural materials for cartons and the like which are generally known as corrugated. The properties of corrugated board are known to be strength in both impact and stress, but having a directional weakness in that the fundamental support strength runs in one direction.

10 This invention relates to the strength of formed and laminated material such as paper, plastic or metals, in semi stiff sheets or rolls, to provide a structure in which the strength is of a non directional nature and allowing for the provision of strength and other qualities, if necessary, in any direction of choice, according to design requirement.

- 20 I understand that the presently known corrugated board has a directional form and is made of laminates of a strong paper which, when adhering to each other, provide a substantially rigid structure for use in general packaging; the structure of this form of material has not changed radically, if at all, over many years, except for technical development of adhesives and paper substance.

- 25 The structural configurations of corrugated are basically standard and are known as fluted, in one form or another.

- 30 According to my invention there is provided a structure which allows for similar strength to that of the product mentioned, but multi directional in nature, which effect is achieved by replacing the known fluted structure with a structure that is substantially cellular in composition, or by combining flutes in such a way that the strength of the resultant board is multi directional.

- 40 One embodiment of my invention provides two or more pieces of known corrugated board laminated together with the longitudinal axes of the flutes of one piece of board lying at an angle to the flutes of the other or others.

- 45 If two pieces of corrugated board are used, then it is envisaged that the flutes of each piece will lie substantially at right angles to each other, although other configurations may be used according to design requirement. (see Fig. 2)

- 50 Although this board, which we call cross corrugated, can be made by taking board which is produced in-line by known production methods and cutting it into sections which are then placed, say, at right angles to each other and then stuck together, it is also envisaged that cross corrugated board may be produced using an in-line process.

- 55 Ordinary double corrugated board as known is produced by passing sheets of paper which have been processed and made pliable by steam, between two rollers which rollers move together in the manner of cogs and compress the pliable paper between their external sur-

- faces. The flutes or corrugations formed thus have their longitudinal axes at right angles to the direction in which the paper is moving between the rollers. Two layers of fluted paper are then laminated with three sheets of flat paper to produce double corrugated board.

- 70 According to my invention the corrugating rollers which form the fluted medium will have substantially diagonal configurations which configurations, when suitably treated sheets of paper are passed between them, will produce flutes which run in a direction substantially diagonal to the direction in which the paper moves between the rollers.

- 75 If two sheets of diagonally fluted medium are laminated together with three sheets of flat paper in such a way that the flutes of one are at right angles to those of the other, then cross corrugated board will be formed using a similar in line process to that process at present in use.

- 80 A further embodiment of my invention will be described as follows: there is provided a strong paper which will be softened by steam in the process of passing through a machine. The paper may be formed of one layer or two adhering together to form an initially strong laminate which, when softened, will be made pliable enough to allow for moulding it into cellular or honeycomb structural configurations in the form of pyramidal or truncated pyramidal configurations.

- 85 When the flat sheet is passing through the machine, the process is as follows: the paper starts dry, and passes through a steam softening section and then through two rollers which have formed around their outer surfaces a multiplicity of substantially pyramidal configurations of male and female locations so that, as the now pliable sheet passes between the rollers, the pressure between the rollers will deform the said pliable paper sheet into the configurations corresponding with those on the rollers.

- 100 From the rolling unit it continues through a quick drying chamber and is then stored for further use.

- 105 I note that when it leaves the chamber it will be dry, and the pyramidal configuration will be formed upstanding and rigid. This material is the foundation of the final end requirement which is explained below; it is now ready for its performance as a laminate.

- 110 A sheet of paper is passed through a known laminating machine in conjunction with the aforementioned material, and the two are then glued together to form part of a sandwich.

- 115 A second sheet of paper in the same process is glued to the opposite side to complete the sandwich, and the completed sandwich then travels through the machine to be cut to length.

- 120 I understand that this process will provide a substantially rigid board from only three or four layers of paper. (see Fig. 3)

In the event that only one layer of paper can be softened and rolled to form the multiple pyramidal effect, then in this example only three laminates make up the product.

5 Preferably, however, the moulded laminate is made of two separate sheets glued together.

10 My reason for this claim is that the single sheet moulded laminate, having directional grain, may be difficult to form through the rollers and remain rigid after drying, whereas the second example of a double laminate has the advantage of the properties of the glue used to secure them.

15 The glue in this product may be of paramount importance; it must be water soluble so that, when the glued sheets pass through the steam section, the steam will not only soften the paper but also the glue. The glue will form a jelly between the sheets and still hold them together.

20 Having passed between the rollers and been pressed into the pyramidal pattern, and then gone through the drying chamber, the glue will dry along with the paper and so hold the two sheets in the pattern made.

25 The chemical content of the glue requires that it has sufficient strength as normal to hold the two sheets firmly together, but must liquefy quickly under steam treatment and solidify quickly in the drying chamber.

30 I understand that this method is novel and may use many kinds of paper or board in any number of moulded and flat laminates chosen according to required thickness of the end product.

35 The steam treatment is only necessary in the forming of the glued double moulded laminate which is the content of the final sandwich.

40 I anticipate that the pre formed moulded laminate may be die pressed instead of using rollers, provided that the paper and the glue are dampened sufficiently to allow for distortion into the pyramidal configurations.

45 Furthermore, the upstanding moulded configurations are not necessarily confined to pyramidal shape, but may be ridged in directional pattern, either continuous or intermittent in layout according to design requirement (see Fig. 1)

50 A further embodiment of this invention is that plastic or wire mesh may be used to strengthen the paper laminates, for example, a wire mesh will be sandwiched between at least two layers of paper, or a moulded plastic in the form of, say, honeycomb, will be sandwiched between two layers of paper.

55 I understand that any combination of the above mentioned laminates may be contrived to suit a special purpose, and will pass through a moulding process of either surface patterned embossed rollers under pressure, which may use either steam or heat or any suitable process to soften the laminates before

moulding or flat bed die pressing, to achieve the same result. This combination of laminates will then be laminated between at least two sheets of paper to form a sandwich which will in turn provide a rigid or semi rigid structure for use in packaging and the like.

70 Finally I understand that the embossed paper will form the content of a sandwich with at least one other sheet of plain paper, but it is preferable if there is a plain paper laminate on either side.

75 If wire were to form the content of the sandwich between the plain paper, it may be in directional, line or mesh configuration, and I note that it may still be press moulded if required into pyramidal configurations, and then again laminated with plain paper and then cut into lengths.

80 If plastic is used as a laminate, it must be pre formed and moulded into an arrangement of substantially pyramidal projections or ridged in a particular pattern as suggested, and then it will be laminated with paper.

85 Any combination of these materials will form the basis of a strong structure of laminates—metal and plastic wire, honeycomb structured plastic, plastic foam, wire and foam, all in general combination with a paper facing or backing or double facing.

90 In a further embodiment of this invention the flat sheet material used as described may be made of plastic or any other suitable material according to design requirement.

95 Examples of possible cellular arrangements are provided in Figs. 4 and 5.

## CLAIMS

1. A rigid or semi rigid structure for use in packaging generally and for other uses such as furniture and partitions in buildings depending on the materials used and design requirement, which structure is formed by laminating a substantially cellular structure with layers of sheet material to provide a product which does not display the characteristic of directional weakness shown by known corrugated board and the like unless a particular directional weakness should be incorporated by design requirement for a particular purpose.

2. A structure according to claim 1 wherein two sheets of known single face corrugated board are laminated together, the direction of the flutes with one sheet of board being at an angle to the flutes within the other.

3. A structure according to claim 1 wherein more than two sheets of known single face corrugated board are laminated together, the flutes within at least two of the comprising sheets being at an angle to each other.

4. A structure according to claim 1 wherein two or more sheets of fluted medium are laminated together with two or more

sheets of plane material in any order, at least two of the flutes being at an angle to each other.

5. A structure according to claims 2, 3 or 4 wherein said laminate is produced using machinery substantially similar to existing corrugated board manufacturing machinery except that the corrugating rollers produce flutes running diagonally or at an angle to the length of the fluted medium.

6. A structure according to claim 1 wherein said cellular structure is defined as a sheet material contoured by a multiplicity of alternate upstanding and indented shapes, which shapes are reproduced in reverse on the lower surface.

7. A structure according to claim 1 wherein said cellular structure is defined as a sheet of plastic foam.

8. A structure according to claim 1 wherein said cellular structure is defined as a honeycomb structure.

9. A structure according to claim 1 wherein a combination of substantially cellular structures are layered in between sheets of plane material.

10. A structure according to any one of claims 1-9 wherein said structure comprises paper and water soluble glue.

11. A structure according to any one of claims 1-9 wherein said structure comprises paper, plastics and suitable adhesive.

12. A structure according to any one of claims 1-9 wherein said structure comprises paper, wood pulp and suitable adhesive.

13. A structure according to any one of claims 1-9 wherein said structure comprises paper, wood pulp, plastics, metal or adhesive, either singly or in any combination of two or more of said component materials to suit design requirements.

14. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.